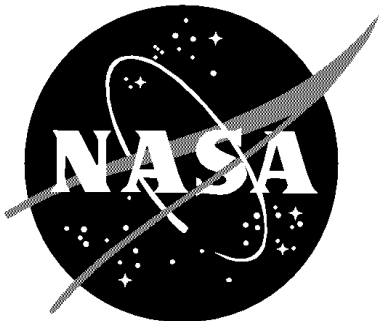

National Aeronautics and Space Administration

May 8, 2000

NRA-00-OES-03

RESEARCH ANNOUNCEMENT

VALIDATION STUDIES FOR DATA PRODUCTS FROM THE EARTH OBSERVING SYSTEM AQUA (PM) PLATFORM AND EOS-RELATED SPECTROSCOPIC STUDIES

Letter of Intent due June 5, 2000
Proposals due July 13, 2000

OMB Approval No. 2700-0042

VALIDATION STUDIES FOR DATA PRODUCTS FROM THE EARTH OBSERVING SYSTEM AQUA (PM) PLATFORM AND EOS-RELATED SPECTROSCOPIC STUDIES

NASA Research Announcement
Soliciting Research Proposals
For Research Commencing
On or After
November 1, 2000

NRA 00-OES-03

Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546

VALIDATION STUDIES FOR DATA PRODUCTS OF THE EARTH OBSERVING SYSTEM AQUA (PM) PLATFORM AND EOS-RELATED SPECTROSCOPIC STUDIES

I. INTRODUCTION

The National Aeronautics and Space Administration (NASA) announces the solicitation of proposals for scientific investigations in support of research specific to validation of data products from the Earth Observing System (EOS) Aqua (formerly PM) platform. Proposals are requested for the support of activities that will enhance, supplement and/or complement activities planned by the EOS Instrument Science Teams to characterize and validate the accuracy of remotely-sensed geophysical parameters derived by the Instrument Science Teams from measurements by EOS satellite sensors, specifically the Advanced Microwave Scanning Radiometer (AMSR-E) and the Atmospheric Infrared Sounder (AIRS)/Advanced Microwave Sounding Unit (AMSU-A)/ Humidity Sounder for Brazil (HSB) instrument suite (hereafter AIRS) on the Aqua platform. In addition, proposals are requested for investigations that address specific needs for spectroscopic data, or improvements thereof, associated with algorithms, or algorithm development, by EOS Instrument Science Teams for retrieval of geophysical parameters from measurements by EOS sensors on the Aqua and CHEM platforms. Technical details are given in Appendix A.

There are specific instructions for writing proposals in response to NASA Research Announcements. Please see Appendices B, C, and D for necessary details and forms.

This announcement is open to the international scientific community. Proposals from non-U.S. institutions are encouraged, but only on a "no-exchange-of-funds" basis. Specific instructions for proposals from non-U.S. institutions are included in Appendix B.

International cooperative proposals, with co-investigators from U.S. institutions participating in foreign-led proposals or with co-investigators from non-U.S. institutions on the teams of proposals from U.S. institutions, are also encouraged. These proposals should also be on a "no-exchange-of-funds" basis for their non-U.S. elements and should identify any requirements for NASA financial support.

The present announcement is for selection of investigations to be carried out for a period of up to 3 years, although NASA reserves the option of extending the duration of some of the selected investigations, if necessary. Because EOS is an evolving program, it is anticipated that there will be later announcements to solicit additional participation by researchers in the Earth science community. Solicitations, such as this announcement, will be issued periodically during the EOS program to replace and/or select additional studies appropriate for further projects of the EOS program (e.g., CHEM).

All investigators selected as a result of this announcement are expected to make available to NASA all developed techniques, methods of analysis, results and data over the course of their investigation, in agreement with the NASA Earth Science Enterprise Data Policy (http://www.earth.nasa.gov/visions/data-policy.html).

Although the Earth Observing System is an approved program, the selection and deselection of instruments, as well as the scheduling of payloads on EOS flights, is subject to change based on national scientific priorities. Currently, these are established using advice from the U.S. National Academy of Science and the EOS Investigators Working Group and are subject to the guidance that NASA receives from the Executive Branch and the Congress. The U.S. Government obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals determined to be acceptable by the Government for award under this announcement.

This announcement and appendices are available on the Office of Earth Science home page on the World Wide Web. The URL address is:

http://www.earth.nasa.gov/ (look under "Research Opportunities")

Approximately $2 million per year is expected to support proposals selected for the EOS Validation Program under this announcement. This NASA Research Announcement will support approximately 15-20 new proposal awards, with annual budgets in the $50,000-$200,000 range and a nominal award duration of three years (subject to annual review). It is anticipated that only 3-4 of the selected proposals will address spectroscopic requirements. Year-by-year support of selected proposals is contingent upon satisfactory performance, continued relevance, and the availability of funds.

Additional information is provided in Appendices A-E of this Announcement. Appendix A provides technical and programmatic information concerning the scope, foci, and objectives of the scientific activities covered by this announcement, as well as specific instructions for proposers to this announcement. Appendix B contains general instructions needed for preparation of solicited proposals in response to NASA Research Announcements, and guidance for international participation. Appendix C provides proposal cover sheet form and related declarations, suggested table of contents, and instructions regarding declaration of current and pending support. Appendix D provides instructions for the Budget Summary. Appendix E provides background information concerning airborne science requirements including points-of-contact and FY2000 flight costs for planning purposes.

II. PROPOSAL SUBMISSION AND SELECTION SCHEDULE

All prospective proposers are strongly encouraged to submit a letter of intent to propose in response to this announcement by the close of business on April 14, 2000. This letter will help to expedite planning for the peer review. The letter of intent may be submitted electronically through the Internet by completing the forms at URL: http://www.earth.nasa.gov/LOI. You are urged to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- NRA Identifier;
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of your proposal including any plans for aircraft usage (Please limit this summary to no more than 3000 characters).

All proposals submitted in response to this announcement are due by the close of business on May 19, 2000. Late proposals will not be considered for review and funding, unless it is judged to be in the interest of the U.S. Government. All proposals submitted in response to this announcement must have a completed cover-sheet form and information on current and pending research support from all other sources attached (see Appendices B and C). All proposals from investigators from the U.S. and other countries will be evaluated by NASA. A complete proposal schedule is given below:

Letter of Intent to Propose due	June 5, 2000
Proposals due	July 13, 2000
Peer Review by Mail	July 14 - September 11, 2000
Meeting of Peer-Review Panels	September 26-28, 2000
Announcement of Final Selections	November 1, 2000

Please submit proposals following the exact protocol noted below. Proposals not submitted to this specific address will likely result in a delay in receipt of proposals.

Identifier: NRA 00-OES-03

Submit proposals to:
NASA Peer Review Services, Code Y
EOS Aqua Validation
500 E Street, SW, Suite 200
Washington, DC 20024-2760
(For overnight delivery purposes only,
the recipient telephone number is 202-479-9030)

Number of Copies Required: 10

Selecting Official:
Director, Research Division
Office of Earth Science
NASA Headquarters

Point of Contact for General Information on EOS Validation Activities:
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Points of Contact for Aqua Mission:
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Aqua Program Scientist
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Claire Parkinson
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Additional information about any of the specific technical areas described in Appendix A may be obtained by referencing the team points of contact identified in Appendix A.

Your interest and cooperation in participating in this opportunity are appreciated.

ORIGINAL SIGNED BY

Ghassem R. Asrar
Associate Administrator for
Office of Earth Science

Enclosures:
Appendix A. Technical Description and Specific Guidelines for Proposers
Appendix B. Instructions for Responding to NASA Research Announcements (NRA)
Appendix C. Proposal Cover Sheet; Certifications, Disclosures, and Assurances Regarding Lobbying, Debarment And Suspension; and Letter Of Intent
Appendix D. Budget Summary
Appendix E. Airborne Science Points of Contact and Flight Cost Estimates

Appendix A

Technical Description and Specific Guidelines for Proposers

A.I Guidelines and General Background

Proposals are solicited for activities that support, enhance, supplement, or complement data product validation activities planned by the EOS Instrument and Interdisciplinary Science Teams. Specifically, this solicitation is limited to validation of standard data products derived from measurements by the Advanced Microwave Scanning Radiometer (AMSR-E) sensor and the Atmospheric Infrared Sounder (AIRS)/Advanced Microwave Sounding Unit (AMSU-A)/ Humidity Sounder for Brazil (HSB) instrument suite (hereafter AIRS) on the Aqua platform scheduled for launch in December 2000. In addition, proposals are solicited for investigations that address specific needs for spectroscopic data, or improvements thereof, associated with algorithms, or algorithm development, by EOS Instrument Science Teams for retrieval of geophysical parameters from measurements by EOS sensors on the Aqua and CHEM platforms. Launch of CHEM is presently planned for December 2002. Another NRA is planned in 2001 to solicit proposals for investigations focused on validation of the data products derived from measurements by the MODIS and CERES instruments. Present investigations concerning the validation of Terra measurements, supported via NRA-97-MTPE-03, may re-compete at that time.

The overall goal of this program is to quantify the accuracy and provide validation for remote sensing observations and retrieved geophysical parameters used for evaluating regional and interseasonal to interannual changes and trends in the atmosphere, and for land and oceanic environments. Validation activities seek to characterize and / or improve the accuracy of the data products. Investigations that seek to quantify the geographical, seasonal and environmental sensitivities of the accuracy characteristics of EOS data products are desired.

Investigations are solicited that consider EOS data products in the following categories:

1) Instrument level data products, i.e., calibrated and geolocated data (usually radiances);

2) Fundamental geophysical parameters (derived from Level 1 products) retrieved at the space and time scales of the individual satellite measurements, i.e., instantaneous observations for the instrument field of view (FOV);

3) Gridded and mapped data on uniform space and time scales with global coverage (derived from Level 1 and 2 products); and

4) Higher order data products produced by combining satellite remote sensing measurements of fundamental geophysical parameters, usually incorporating model calculations and/or other observations or analyses, and often on uniform space and time grids (derived from Level 2 and 3 products).

Priorities for scientific data product validation are based on the sequential and dependent nature of the EOS data production chain. Given the limited available resources, higher priority will be

given here to studies of the more fundamental data products on which the accuracy of higher order products inherently depend. The highest priority for EOS science data validation will here be given to Level 1 and Level 2 products, called fundamental remote sensing products, with emphasis on products that have multi-product impacts. Comparative studies of similar remote sensing products are encouraged, e.g., AIRS versus MODIS, or EOS data products versus comparable products produced from operational or other research and commercial satellites.

The EOS Validation Program presently includes substantial planned efforts to be conducted by the EOS Instrument Science Teams. It is not the intention here to support investigations that duplicate or compete with those existing investigations. In particular, investigations that propose to develop competing algorithms for the analysis of Aqua data will not be supported via this NRA. Rather, investigations that support, enhance, supplement and/or complement the planned data validation activities are solicited by this announcement. For example, if a strong and relatively comprehensive data validation activity is already incorporated in the plans of a particular instrument team, then proposals in that area would not have a high priority here despite the inherent value placed on such an activity. Summaries of the AMSR-E and AIRS data validation plans are given in this Appendix. Proposal that provide unique and important additional contributions to the validation of the AMSR-E and AIRS standard data products are encouraged, including those that address deficiencies in the team activities, whether recognized by the teams or not.

Investigators wishing to propose airborne missions focused on validation of Aqua data products must recognize that the Instrument Science Team Validation Plans include substantial airborne field experiment activities. These activities are primarily funded from the individual Instrument Science Team budgets and not through this NRA. Although some of the proposed airborne missions are independent in character, many are coordinated with, and substantially benefit from, field experiments supported by other NASA Research and Analysis (R&A) Programs or other agencies. While not precluded, proposals for additional flight programs utilizing NASA aircraft resources to validate the EOS data products will be evaluated in the context of the existing EOS Validation flight program. Thus, it is highly recommended that proposals requiring NASA aircraft resources be coordinated with existing Instrument Science Team plans. Moreover, NASA-sponsored aircraft resources are heavily used by all R&A and EOS-related programs, and, hence, must be carefully planned in a cooperative manner in order to insure the maximum amount of science return for the available resources. The NASA Airborne Science Flight Program now requires such programmatic coordination, as well as flight hour costs provided by the researcher. The planning points-of-contact and flight hour costs for FY2000 were provided to potential aircraft users in May 1999. The substance of that guidance is given here in Appendix E for your assistance in scoping requirements for airborne resources in your proposal.

Proposers must, therefore, be knowledgeable about the specific EOS data products and corresponding Instrument Science Team validation plans for the Aqua platform, or spectroscopic data needs for Aqua and CHEM. Brief synopses of the validation plans, including planned and desired elements, are given in this Appendix along with points of contact for the Instrument Science Team investigations. Detailed descriptions of needs for spectroscopic data and relevant team points of contact are also given later in this Appendix. The full Instrument Science Team Data Validation Plans and detailed summaries, as well as other information about the EOS

Validation Program and related national and international resources and facilities, may be found on the EOS Project Science Office home page. The URL address is:

http://eospso.gsfc.nasa.gov/validation/valpage.html (look under Documents).

Additional information on EOS, the Instrument Science Teams and the data products may also be obtained from the EOS Project Science Office home page (http://eospso.gsfc.nasa.gov/). The EOS Reference Handbook, the EOS Data Products Handbook, and the Algorithm Theoretical Basis Documents (ATBDs) produced by the Instrument Science Teams will be of particular utility (look under EOS Publications).

A strong collaborative working relationship is sought between EOS validation investigations funded through this solicitation and the appropriate EOS Instrument Science Teams. *Where appropriate, successful investigators will become Affiliate Members, or equivalent, of an Instrument Science Team and will be expected to participate fully in and be responsive to the activities and needs of that team.* This will facilitate investigator access to the satellite data at an early stage and increase the relevance and rapid impact of the validation activities, or data collection, funded here. Contact between prospective investigators and the Instrument Science Teams is highly encouraged to assist in the formulation of appropriate proposals. While members of the Instrument and Interdisciplinary Science Teams may respond to this solicitation, *a principal motivation of this solicitation is to bring new resources, especially human resources and expertise, to bear on the task of validating the EOS data products*.

The intention to forge an integrated EOS science data validation effort, as noted above, should not be construed as discouraging proposals that seek to apply independent, innovative, cost-effective approaches to the task of EOS science data validation that may not be presently recognized by the Instrument Science Teams.

Proposals to provide specific correlative data products in support of validation of EOS data products and Instrument Science Team validation activities will be considered. Proposals to provide data management functions with respect to such data will also be considered. The need for such a function must be clearly evident. Strong preference will be given to proposals that augment and leverage existing networks, capabilities or facilities, as opposed to development of new observing networks, capabilities or facilities. *Proposals involving collection of correlative measurements must commit to providing their correlative measurements in a timely manner with appropriate quality control and documentation to the appropriate Instrument Science Teams where it will be made publicly available from either their Science Computing Facility (SCF) or alternatively from an appropriate EOS Distributed Active Archive Center (DAAC).* In addition, investigators are expected to participate in community activities to define appropriate measurement and calibration protocols for field measurements, adhere to those protocols, and participate in community calibration activities for field measurement sensors. It is expected that the EOS Calibration Scientist, Instrument Science Teams, EOS Investigator Working Group or other components of EOS, will help organize such community activities with respect to field measurements. Budgets should account for travel to participate in such community activities, i.e., meetings and travel to calibration facilities.

It is expected that all validation or correlative measurements obtained by investigators funded here, or obtained by the EOS Instrument Science Teams, will be publicly accessible though an SCF or DAAC validation home page for each specific instrument or EOS data product. The purpose of this policy is to further the scientific benefit derived from EOS validation activities by providing data access to the broadest scientific community.

Proposals seeking to provide needed spectroscopic data, or improvements thereof, must commit to providing such data and results directly to the appropriate EOS Instrument Team, and also to the HITRAN Spectroscopic Database (http://www.HITRAN.com/). HITRAN is supported by the EOS Project Science Office as the publicly-accessible repository of the most-advanced, peer-reviewed, spectroscopic database for remote sensing, and other, applications.

A.II Overview of Team Validation Plans for the EOS Aqua Mission

A.II.1 AIRS Validation Plan Overview

Core Data Products

The standard AIRS/AMSU-A/HSB science data products are briefly summarized below. Detailed descriptions of each standard data product, and the methods by which it is derived, may be found in the corresponding Algorithm Theoretical Basis Document (ATBD) available on the EOS Project Science Office home page on the World Wide Web at URL address: http://eospso.gsfc.nasa.gov/ (look under "Publications"). All EOS standard science data products are denoted by a unique data product number (e.g., AIR02) given here to facilitate access to pertinent reference data bases.

Radiance Measurements, Level 1 Products

Level 1-B Radiance, AIRS (AIR02)

Calibrated, time-tagged and geolocated AIRS instrument radiances

Level 1-B Radiance, AMSU-A (AMS02)

Calibrated, time-tagged and geolocated AMSU-A instrument radiances

Level 1-B Radiance, HSB (MHS02)

Calibrated, time-tagged and geolocated HSB instrument radiances

Derived Geophysical Products, Level 2 Products

Cloud Products (AIR04)

The core cloud products consist of cloud cover, cloud height, cloud top temperature and cloud emissivity at four selected infrared wavelength bands. The spatial resolution of these products is defined by the AIRS individual field of view, or 13.5 km at nadir.

Humidity Products (AIR05)

The humidity products include the humidity profile at 2 km layers in the troposphere and the column-integrated total amount of water vapor. The spatial resolution of the humidity products is on the AMSU-A footprint, roughly 40 km at nadir.

Temperature Products (AIR07)

The temperature products include the vertical temperature profile at 1 km levels in the troposphere, sea surface temperature, land surface temperature and its associated land surface emissivity, and a day minus night surface temperature. The spatial resolution of the temperature products is on the AMSU-A footprint, roughly 40 km at nadir.

Ozone Product (AIR08)

The ozone product is total column ozone amount at a spatial resolution of 45 km at nadir.

Radiance, Cloud-cleared (AIR09)

The cloud-cleared radiance product is produced at a resolution of the AMSU-A footprint, 40 km at nadir.

Major Elements of AIRS Validation

The AIRS Instrument Science Team validation activities encompass three major areas:

1. Spectroscopic Validation
2. Forward Model Validation
3. Standard Product Validation

Spectroscopic validation refers to the molecular physics that goes into a line-by-line transmittance/ radiance algorithm. Spectroscopic validation includes (a) calculations, laboratory measurements and analysis of spectra that are not sufficiently well known for AIRS applications at relevant atmospheric pressure and temperature conditions, (b) field measurements of atmospheric spectra that cannot be adequately characterized in the laboratory (generally due to insufficient optical depths in the lab), and (c) validating field measurements of atmospheric spectra. (a) and (b) will be used to improve spectroscopic models while (c) will be used to validate the spectroscopic models in the real atmosphere. (b) and (c) are related, but (b) is much more demanding in that it is assumed that *in-situ* measurements of the atmospheric state are more accurate than spectroscopic measurements. Further detail about the requirements for laboratory measurements (or calculations) of spectroscopic parameters are described here in Appendix A.III.1.

Forward model validation tests (a) the fast parameterization of the spectroscopy in the form of the fast transmittance algorithm, (b) the fast radiance algorithm that uses these fast transmittances, (c) the instrument spectral response function used in (a), and (d) the computer codes used in (a)-(c). The AIRS Radiative Transfer Validation Model (RTVM) is the link between line-by-line codes and the fast forward radiance model. Development of a spectral catalogue for clouds and surfaces and the study of surface inhomogeneity effects are critical to accurately understanding the physics and hence the radiative transfer modeling and thus improving the accuracy of the products. Field observations are essential to these latter aspects. Extensive comparisons to measurements by other satellite systems (cross-calibration), on Aqua and other satellite platforms are another key element, in addition to airborne measurements of atmospheric spectra, to enable validation of the forward model and validation of the radiance calibration for AIRS Level 1 data products.

Validation of the Level 2 AIRS standard data products, i.e., cloud products, humidity and temperature profile products, and ozone products involve comparisons to correlative data from standard and special observing systems, such as radiosondes, as well as collection and comparative analysis of much more comprehensive data during field experiments. These include

intensive field experiments as well as larger international measurement programs. Another key element of the AIRS validation strategy for its Level 2 data products is to utilize and assess AIRS data in global data assimilation models, such as the operational systems used by the NOAA National Center for Environmental Prediction (NCEP).

Thus, the strategy for validation of AIRS radiances and geophysical products is based on four major components:

- Short-term field campaigns
- Long-term parameter monitoring such as radiosondes
- Long-term statistical analysis of means, variances, trends, etc.
- Verification through the use of AIRS data in assimilation models

Sustaining Validation Efforts	**Intermittent Validation efforts**
Radiosondes	Field campaigns
Surface data	Forward model validation
Cross-instrument validation	Radiance validation Special atmospheric and surface conditions
Comparison of assimilation and analysis products with AIRS products	Ongoing national and international measurement programs (e.g., GEWEX)

The AIRS team validation activities occur in two main phases. The following brief synopses describe the planned validation activities to be conducted by the AIRS team based on present budget projections, i.e., adequate resources (not this NRA) will likely be available for them to accomplish these studies. Thus, prospective proposers to this NRA should not seek to propose for these specific tasks, except in instances where a requirement for additional capability is identified. Rather, NASA seeks investigations that enhance, supplement and/or complement these planned AIRS team activities. Proposed projects can be tightly bound to the AIRS team, highly independent, or intermediate in their relationship to the AIRS team and activities. As noted previously however, adequate paths for timely transmittal of Aqua data, validation results, and / or correlative data must be established between the investigator and the team in most every case. Investigations that utilize or provide additional correlative data sets and / or employ innovative analysis techniques or methodologies are desired. Proposers may benefit from interactions with the AIRS team at an early stage in proposal development, via the AIRS Validation Contact given below, to gain some feedback from the team as to their view of the suitability of the proposal. This should not be misconstrued as indicating that approval of the AIRS team is a necessary requirement for a successful proposal. It is not.

Instrument Check-out and Simple Field Validation (to L+6 months)

Startup of the AIRS will be delayed by the planned orbital maneuvers to provide deep space calibration of CERES and MODIS. Thus, the AIRS checkout and simple field validation phase may not begin in earnest until about 2 months after the launch of Aqua. The objectives of the

instrument checkout activities conducted by the AIRS team are to confirm instrument behavior, including geo-rectification and on-board calibration, as well as analysis and documentation of instrument/sampling artifacts. These activities are essential to completion of the instrument model used for processing AIRS data. The objective of the simple field validation activities are to validate the basic forward model (and spectroscopic parameters) used for the retrievals as well as for vicarious calibration of the observed radiances. The simple field validation activity focuses on observations of cloud-free calm ocean conditions and will be conducted in collaboration with sea-going initialization cruises planned by MODIS. Adequate characterization of the overlying atmosphere is required and airborne observations of spectra are desired. In addition, the AIRS team will conduct extensive comparisons to measurements by other satellite systems (cross-calibration), on Aqua and other satellite platforms, to enable validation of the forward model and validation of the radiance calibration for AIRS Level 1 data products. The cross-calibration activity as well as utilization of any additional opportunities to acquire and analyze suitable clear-sky ocean data sets will continue through the life of the mission.

Validation of Level 2 Data Products (after L+5 months)

Validation of the AIRS Level 2 standard data products by the AIRS team will involve a mix of activities including sustaining and intermittent activities as noted above. Of fundamental importance to the retrieval of temperature and humidity profiles is the validation of the AIRS cloud products. The AIRS team will rely heavily on comparisons to the MODIS cloud mask as well as comparisons to cloud property retrievals from other satellite sensors such as AVHRR to validate the AIRS cloud product. Given the size of the AIRS/AMSU-B/HSB footprints, utilization of field data for this purpose is not of high priority due to the inherent scale mismatch. Validation of the ozone data will be accomplished primarily via comparison to readily available data sets, such as TOMS. For the validation of the temperature and humidity profile data products, the AIRS team will conduct two AIRS-unique high priority validation activities in addition to assessments derived from comparison to more standard correlative data sets (routine operational radiosonde data) and incorporation into operational data assimilation systems.

Routine Collection of Comprehensive Data Sets

The first activity involves a comprehensive set of correlative observations of the quantities derived from AIRS/AMSU-A/HSB measurements. This is the highest priority of the AIRS team. Most of these observations will be obtained from ground-based and balloon-borne instruments at well-instrumented locations including the U.S. Department of Energy (DoE) Atmospheric Radiation Measurement (ARM) Program Clouds and Atmosphere and Radiation Testbed (CART) sites. The fundamental observational set includes observations for approximately one season (three months) beginning six months after launch of the EOS Aqua platform. In addition to ground-based observations and radiosonde flights, occasional coordinated overflights with well-instrumented aircraft will be used to characterize the upwelling radiance in both the infrared and the microwave spectral regions. Follow-on data sets will be collected and analyzed during three one-month periods per year during operation of the AIRS instrument suite.

The observations will include surface properties, temperature profiles, water vapor profiles, ozone profiles, cloud properties, and several baseline sets of spectral radiance observations. Upwelling infrared and microwave radiances observed from ER-2 are a desirable component, but are a lower priority. The observations will be obtained at the following DoE ARM/CART site locations:

1) Southern Great Plains (SGP) site,
2) Tropical West Pacific (TWP) site, and
3) North Slope of Alaska (NSA) site.

Additional sites representative of other climatic regimes are also sought, such as an Amazon location. While the initial three-month observing period is most important, the continuing one-month observational sets, three per year, during AIRS operation provide important ongoing validation constraints. Critically important is that the correlative observations will be taken at times of actual Aqua overpasses (approximately 1:30 AM and 1:30 PM local standard time).

While the ground-based and balloon-borne observations comprising the comprehensive data set will primarily derive from observational capabilities already existing (or planned) at the ARM CART sites, organization, processing and analysis of these data in manner suitable for efficient application to the task of validating the AIRS data products is needed.

Upper Tropospheric Water Vapor

The second group of high priority AIRS validation observations concerns upper tropospheric water vapor. The upper tropospheric water vapor validation measurements will be needed roughly one year after the startup of the AIRS instrument suite. Water vapor is of great scientific interest and AIRS will provide a high-quality global climatology. Nevertheless, the formal validation of upper tropospheric water vapor will be a difficult task. A field campaign dedicated to its validation is planned and is a high priority of the AIRS Instrument Science Team. Coordinated flights of the ER-2, DC-8 and associated radiosonde launches will be undertaken, similar to the CAMEX-3 field mission (http://ghrc.msfc.nasa.gov/camex3/). This field experiment will occur roughly one year, or later, after the beginning of the AIRS mission and will likely occur in cooperation with CAMEX-4 or other comparable field program planned by a NASA R&A Program, and in association with validation activities of other EOS Instrument Science teams.

The planned upper tropospheric humidity observations are characterized by**:**

- Complete suite of aircraft observations of upper tropospheric water vapor.
- Data collection over subtropical oceanic regions.
- Several hour and / or several hundred kilometer flight paths including clear and cloudy conditions.
- Field mission no earlier than one year after the start of the AIRS mission.

Proposers wishing to participate in the airborne field activities noted here should very carefully review the statements made on this topic in Appendix A.I as well as the specific budget guidance

for this NRA. While the EOS Project Science Office presently provides direct support (not via NRA) for high priority airborne operations focused on validation of EOS data products, such as a partial subsidization of flight hour and mission peculiar costs associated with the use of NASA aircraft, costs for instrument investigators are usually borne by the concerned EOS Instrument Science Team, such as AMSR-E or AIRS. While exceptions to this policy are possible, they will only be made for a truly outstanding and appropriate proposal, both scientifically and programmatically.

The complete Validation Plan for AIRS/AMU-A/HSB is available on the Internet at:

http://eospso.gsfc.nasa.gov/validation/valplans.html

For assistance in obtaining detailed information about AIRS/AMSU-A/HSB investigations and plans, contact:

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A.II.2 AMSR-E Validation Plan Overview

EOS standard data products for the AMSR-E passive microwave instrument are:

Level 1 - brightness temperatures (TBs)

Level 2 and higher - atmospheric and surface parameters retrieved are: precipitation, sea surface temperatures (SST), sea ice concentrations, snow depth and water content, land surface wetness, sea surface wind speed, atmospheric cloud water over the ocean, and water vapor over the ocean.

This NRA solicits activities relating to the validation of Level 2 and 3 products, specifically:

a) Level 2 standard products

PRODUCT	ACCURACY	SPATIAL RESOLUTION (km)
Brightness Temperature	0.2 – 0.7 K	5 - 60
Ocean: Sea Surface Temperature	0.5 K	60
Columnar Water Vapor	0.6 mm	25
Columnar Cloud Water	0.02 mm	25
Wind Speed	0.9 m/s	25
Rainfall: Over oceans	1 mm/hr or 20%	12
Over land	2 mm/hr or 20%	12
Land: Surface soil moisture	0.06 g/cm^3	25 (EASE grid)
Snow: Water equivalent	10 mm or 20%	25 (EASE grid)

b) Level 3 standard products

PRODUCT	ACCURACY	GRID RESOLUTION (km)	TEMPORAL RESOLUTION
Ocean: Sea Surface Temperature	0.5 K	0.25 x 0.25 deg	daily asc and dsc
Columnar Water Vapor	0.6 mm	0.25 x 0.25 deg	daily asc and dsc
Columnar Cloud Water	0.02 mm	0.25 x 0.25 deg	daily asc and dsc
Wind Speed	0.9 m/s	0.25 x 0.25 deg	daily asc and dsc
Rainfall: Over oceans	20%	5 x 5 degrees	monthly
Over land	30%	5 x 5 degrees	monthly
Sea Ice: Concentration	≤5%	6.25, 12.5, 25	daily asc and dsc
Temperature	≤4 K	25	daily asc and dsc
Snow depth on ice	≤5 cm	12.5	5 days
Gridded brightness temp	0.3 – 0.6 K	6.25, 12.5, 25	daily
Land: Surface soil moisture	0.06 g/cm^3	25	daily
Gridded brightness temps	0.3 - 0.6 K	25	daily
Snow: Water equivalent	10 mm or 20%	25 (EASE grid)	5 days

EASE grid is Equal-Area projections grid.

Detailed descriptions of these data products and the methods by which they are derived are available in the AMSR-E ATBDs at URL address:

http://eospso.gsfc.nasa.gov/ (look under "Publications")

Parameter-by-Parameter Summary of AMSR-E Validation Plan

The following brief synopses describe the planned validation activities to be conducted by the AMSR-E team based on present budget projections, i.e., adequate resources (not this NRA) will likely be available for them to accomplish these studies. Thus, prospective proposers to this NRA should not seek to propose for these specific tasks, except in instances where a requirement for additional capability is identified. Rather, NASA seeks investigations that enhance, supplement and/or complement these planned AMSR-E team activities. Proposed projects can be tightly bound to the AMSR-E team, highly independent, or intermediate in their relationship to the AMSR-E team and activities. As noted previously however, adequate paths for timely transmittal of Aqua data, validation results, and / or correlative data must be established between the investigator and the team in most every case. Investigations that utilize or provide additional correlative data sets and / or employ innovative analysis techniques or methodologies are desired. Proposers may benefit from interactions with the AMSR-E team at an early stage in proposal development, via the AMSR-E Validation Contact given below, to gain some feedback from the team as to their view of the suitability of the proposal. This should not be misconstrued as indicating that approval of the AMSR-E team is a necessary requirement for a successful proposal. It is not.

Ocean parameters

Validation Criterion and Method

For SST, wind speed and columnar water vapor amount, the primary AMSR-E validation path will be via comparisons to correlative measurements from operational moored buoys (National Data Buoy Center and Pacific Marine Environmental Laboratory) and island radiosonde (World Meteorological Organization) observations, and to observations from other satellite sensors including data from space-borne microwave sensors, and data from the operational U.S. National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer (AVHRR) sensors for SST. In addition, the wind speed retrievals will be compared to analyses using operational data assimilation systems. Advantage will also be taken of correlative data collected during AIRS validation field experiments for validation of AMSR-E ocean data products.

For columnar cloud water amount, no reliable source of correlative data presently exists. Therefore, data quality will be assessed via histogram analysis, as in Wentz et al., 1997: ‘A well-calibrated ocean algorithm for SSM/I’, JGR, 102(C4), 8703.

Validation Time Line

The AMSR-E team will validate its ocean data product in two steps. The first is a 3-month initial comparison of AMSR-E at-launch data products to data products derived from the U.S. Department of Defense (DoD) Special Sensor Microwave/Imager (SSM/I) and TRMM Microwave Imager (TMI). Observations provided by the SeaWinds sensor on QuikSCAT will also be used for evaluation of the AMSR-E surface wind speed product. A primary focus of this effort is the determination of biases in the AMSR-E retrievals. The algorithms will be corrected based on the results of these comparisons, and an additional 3-month comparison will then be conducted with the revised algorithms. Later, comparisons will also be made to data obtained by the AMSR and SeaWinds sensors on ADEOS II, scheduled for launch by Japan in November 2001. Assessments will continue for the life of the mission.

Rainfall

Validation Criterion and Method

The AMSR-E team will validate its rainfall product using both "ground-truth" and "physical" methodologies. For rainfall over land, carefully processed and merged quantitative radar and rain gauge data will constitute the primary ground-truth correlative data set, building on the heritage of efforts over the last decade. For oceanic rainfall, a combination of ground-truth data and tests of the physical assumptions (models) will be employed. Three well-calibrated ground-based radars will be used, including a tropical island site (Kwajalein), a high-latitude coastal site, and the NASA S-band radar deployed on a temporary basis to a series of sites around the world. The AMSR-E team also plans at least two field missions focused on validation of the rainfall data product for ocean regions. These missions will involve the NASA DC-8, with an extensive remote sensing payload, and a cloud physics aircraft for *in-situ* measurements. A key focus is on the vertical distribution of hydrometeors and sensitivity to location of the radar bright band (melting layer). Planned deployments include a 60-day mission in Northern Hemisphere Summer to the Gulf of Alaska, and another 60-day mission in Southern Hemisphere Winter. Extensive use will also be made of inter-satellite comparisons, including data from AMSR and TMI.

Validation Time Line

1999: select appropriate high-latitude coastal radar site

2000: develop software for processing data from the radar sites

2001: generate products for Kwajalein and high-latitude coastal radar site, select a temporary site for a portable radar

2002: continuously generate products from 3 radar sites; flight campaign (DC-8 and cloud physics aircraft) out of Seattle, WA, in January-March.

2003: continuously generate products from 3 radar sites

2004: continuously generate products from 3 radar sites; flight campaign (DC-8 and a cloud physics aircraft) out of Punta Arenas, Chile.

2005: same as 2003

Sea Ice

Validation Criteria and Method

The AMSR-E team will validate its sea ice concentration data product through comparison with data from other satellite sensors, including high-resolution sensors using infrared and visible channels such as NOAA AVHRR and MODIS, synthetic aperture radar (SAR) such as RADARSAT, and scatterometer/altimeter sensors such as SeaWinds. Temporal consistency checks using time series analysis will also be performed, as will comparisons with high-resolution airborne microwave and aerial camera observations. The sea ice temperature data product will be validated through comparison to field data obtained from ice camps and via deployments from research vessels and corresponding derived empirical relationships and models, to satellite infrared observations (e.g., MODIS), and to buoy data. The snow depth on sea ice data product will be validated through comparison to observations from an airborne range-gated step-frequency radar, and field measurements. A series of AMSR-E airborne field missions are planned for the validation of the AMSR-E sea ice data products. To the extent possible, these missions will be conducted in coordination with planned cruises of research vessels. Comparisons will also be made to operational data assimilation analysis products produced by the European Centre for Medium-range Weather Forecasting (ECMWF) and the U.S. National Center for Environmental Prediction (NCEP). Validation work will also be conducted concerning the planned AMSR-E sea ice "research" products: motion, type and regional classes.

Validation Time Line -- Airborne Validation Experiments

2000: P-3B with a suite of microwave and infrared radiometers, from Thule, Greenland, in July; radar and lidar are also desired.

2001: P-3B over Weddell Sea and Bellingshausen/Amundsen/Ross Seas from Punta Arenas, Chile, in August, in conjunction with ship observations

2002: DC-8 over Bering, Beaufort and Chukchi seas from Fairbanks, AK, in March

2003: same as 2001

2004: same as 2002

Snow

Validation Criterion and Method

The AMSR-E team will validate its snow data product through comparison of retrieved snow water equivalent (SWE) from AMSR-E with operational airborne observations of upwelling gamma radiation collected by the NOAA National Operational Hydrologic Remote Sensing Center (NOHRSC - http://www.nohrsc.nws.gov/) where SWE is related to the attenuation of terrestrial gamma radiation emitted by isotopes in the underlying soil. Comparisons will also be made to field data obtained in joint activities with the MODIS-Land snow product validation effort, including airborne and satellite-derived (SSM/I and high-resolution MODIS data) snow cover observations. Snowfield experiments will be conducted to create a crystal size profile

database that is important for validation of the algorithm. Comparisons will also be made to daily observations from the automated operational network of SNOTEL sites in the western USA and to the output of snowmelt runoff models.

Validation Time Line

2001: aircraft underflights coordinated with NOHRSC gamma flights in FY2001 (December-January) over Northern USA and Alaska

Land Surface

Validation Criterion and Method

The objective is to estimate the soil moisture retrieval error and the space-time error variability with an accuracy goal of ±0.06 g cm^{-3}. The accuracy goal for the surface temperature retrieval is ±2.5°C, and for vegetation water content is ±0.15 kg m^{-2}. The AMSR-E team validation of its land surface data product will be conducted over a range of scales using scale-appropriate approaches:

AMSR-E footprint scale using correlative measurements collected during intensive short-term field experiments, including the U.S. Southern Great Plains (SGP) program centered in Oklahoma in 2001, and through comparison to observations derived from other satellite sensors such as SSM/I, TMI, AMSR, MODIS and AIRS.

Regional scale using continuous measurements from operational networks including the Oklahoma Mesonet, DoE ARM CART sites, NSF Long-Term Ecological Research (LTER) sites, WCRP Baseline Surface Radiation Network (BSRN), soil moisture measurements in the state of Illinois and other networks in Russia, China, Australia, and South Africa. Stations are selected for representative diverse ecosystem/climate regimes and for regional uniformity.

Continental scales in conjunction with international enhanced measurement programs such as the GEWEX Regional Continental-Scale Experiments (GCIP, GAME and LBA) and the IGBP Transects, and also via collaborative studies with the Data Assimilation Office (DAO) at NASA Goddard Space Flight Center, NCEP and ECMWF.

Airborne instrumentation for SGP'01 will likely be comparable to, or exceed, that deployed for SGP'99 (http://hydrolab.arsusda.gov/sgp99/). Key for the validation effort is utilization of a suite of airborne passive microwave radiometers with similar frequencies, polarization and viewing geometry to those of AMSR-E. Airborne active sensors are also highly desired. High-quality ground-based correlative measurements will also be used.

The complete Validation Plan for AMSR-E is available on the Internet at:

http://eospso.gsfc.nasa.gov/validation/valplans.html

For assistance in obtaining detailed information about AMSR-E investigations, contact:

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A.III Requirements for Improvements in Spectroscopic Information

The EOS Validation Program will support a limited number (3-4) of investigations that are highly focused on providing new or improved spectroscopic information for specific species and spectral bands of critical importance to the development and validation of algorithms used to derive geophysical parameters from measurements by EOS sensors on the Aqua and CHEM platforms. Requirements associated with data products to be produced from observations by the High-Resolution Dynamics Limb Sounder (HIRDLS), the Tropospheric Emission Spectrometer (TES) and the Microwave Limb Sounder (MLS) on the CHEM platform are briefly described below. Similar requirements for spectroscopic data in support of the Ozone Monitoring (OMI) are addressed in a separate announcement. Launch of CHEM is presently planned for December 2002. Requirements for spectroscopic studies in support of AIRS on Aqua are also described here. *An absolute requirement for a successful proposal, that addresses these needs, is a commitment to provide the improved spectroscopic information, in suitable form, directly to the concerned Instrument Science Team as well as to submit such data for inclusion into the HITRAN database, where it will be made available to the national and international user community.* Successful proposers are expected to work closely with those entities to ensure successful utilization of the information. As evident below, the best available existing spectroscopic data have not always been submitted into the HITRAN database. This is a significant problem for the Earth remote sensing user community.

A.III.1 AIRS Requirements for Spectroscopic Information

The AIRS utilizes spectroscopic information on key trace gases in its forward radiative models used to invert AIRS infrared spectral data in the retrieval of geophysical parameters such as the atmospheric temperature profile. Improvements in the characterization of line shapes, and the pressure-broadening, pressure-induced shifts and temperature dependence thereof, are desired for relevant atmospheric conditions. The key gases are CO_2, H_2O and O_3.

Of particular importance are:

- water vapor continuum, both in the window region and in the 12-1400 cm^{-1} band.

- shape of strong water vapor lines over a range of temperature, especially at locations from about 1 to 10 cm^{-1} from line centers.

For assistance in obtaining more detailed information about AIRS requirements, see Appendix A.II.1 and the points of contact provided therein.

A.III.2 HIRDLS Requirements for Spectroscopic Information

The HIRDLS will measure the abundance of O_3, H_2O, CH_4, N_2O, NO_2, HNO_3, N_2O_5, $CFCl_3$, CF_2Cl_2, $ClONO_2$, and aerosols, as well as temperature and cloud locations. Retrievals will depend on knowledge of absorption cross sections for target species and any interfering species. Absorption cross sections will be derived from spectral line strengths and shapes plus line mixing (line by line cases), or more directly from lab measurements for "heavy" molecules, e.g., CF_2Cl_2, with highly complex spectra. The accuracy objectives for constituent abundance at altitudes below 50 km are 5-10% absolute with a precision of 1-5%. Inadequate spectroscopic knowledge is only one of many sources of error, so the error budget for spectroscopy information must be better than these overall accuracy objectives.

The upper troposphere and lower stratosphere are scientifically important regions where temperatures can be less than 200 K. This is a potential problem since the quality of spectral data is generally worse at low temperatures. Also, the narrow HIRDLS filter widths (15 to 120 cm^{-1}) pose a more stringent requirement than in the case of broader filters designed to sample an entire band, i.e., uncertainty about a specific spectra feature within the filter bandpass region may have a greater relative effect. Thus, the quality of spectral data in the filter bandpass region may be inadequate even if the database for that region generally is considered to be good.

Compilation of Existing Data

Many laboratory measurements of spectral parameters have not yet been included in the HITRAN database and could provide significant improvements. Of particular importance to HIRDLS is getting the available data on HCFCs, including pressure and temperature dependencies, and also getting the available information on aerosol indices of refraction into the HITRAN database.

New/Improved Spectroscopic Data

New studies are needed to characterize species for which spectroscopic information is missing or of poor accuracy. Specific priorities are given below.

- $ClONO_2$, N_2O_5, $CFCl_3$, CF_2Cl_2: Cross sections and temperature dependencies are needed to allow low-temperature (< 200 K) calculations. Pressure dependencies are also needed.

- H_2O: Improved information on halfwidths and temperature dependencies is needed in all spectral regions.

- HNO_3: Information for 11 and 7 μm bands needs improvement.

- H_2O continuum: Improvements needed for tropospheric measurements.

For assistance in obtaining more detailed information about HIRDLS requirements, contact:

John C. Gille, U.S. Principal Investigator for HIRDLS
NCAR and University of Colorado
3300 Mitchell Lane, Suite 275
Boulder, Colorado 80301 USA
Tel: (303) 497-8062
Fax: (303) 497-2920
Email: gille@ucar.edu

A.III.3 MLS Requirements for Spectroscopic Information

The EOS CHEM MLS provides chemistry measurements of the lower stratosphere and upper troposphere including temperature and concentrations of H_2O, O_3, ClO, BrO, HCl, OH, HOCl, HO_2, HNO_3, HCN, N_2O, SO_2, and CO using a measurements of atmospheric emission at spectral bands in the millimeter and sub-millimeter range. The measurements of OH, HO_2 and BrO are unique to MLS on the CHEM platform. Improved knowledge of various spectroscopic parameters would provide a valuable contribution to improving the accuracy of MLS measurements. The highest priority needs are indicated below. Other valuable, but lower priority, contributions would include verification of previous laboratory data for other emission lines of relevance.

<u>Highest Priority</u>

Continuum absorption (desired accuracy of 5% or better)

- Better laboratory measurements and theoretical expressions for water vapor and dry air continuum absorption are desired at frequencies between 100 and 2500 GHz, and for conditions representative of upper troposphere. The most important need is for the region 177-207 GHz to improve the accuracy of tropospheric humidity retrievals. Improved knowledge in other spectral regions (230-248 GHz, 632-668 GHz, and 2.5-2.55 THz) is also very important. Laboratory measurements are currently planned.

Linewidth parameters, including temperature dependence (desired accuracy of 3% or better):

- 2.5 THz lines of OH, O_2, and H_2O to improve accuracy of OH measurement (OH: 2.510 THz and 2.514 THz; O_2: 2.502 THz; H_2O: 2.532 THz).

- HCl line at 625.9 GHz to improve accuracy of chlorine loading measurement.

- $^{18}O^{16}O$ (isotopic O_2) line at 233.9 GHz to improve accuracy of temperature measurement.

- O_3 lines to improve accuracy of ozone measurement. (235.7 GHz, 237.1 GHz, 242.3 GHz, 243.5 GHz, 625.4 GHz, 2.51 THz, 2.54 THz)

- HO_2 lines at 649.7 and 660.5 GHz to improve accuracy of HO_2 measurement.

- BrO lines at 624.8 and 650.2 GHz to improve accuracy of bromine measurement.

Some of these laboratory measurements are planned as part of the continuing spectroscopy program at JPL.

High Priority

Other linewidth parameters, including temperature dependence, to improve accuracy of concentration measurements for various species:

- HCN line at 177.3 GHz
- CO line at 230.5 GHz
- HOCl line at 635.9 GHz
- CH_3CN lines at 183.9, 202.3, 624.8, 626.4, and 660.7 GHz
- O_3 lines at 239.1, 231.3, 248.2, 249.8, and 250.0 GHz to improve CO retrievals

For assistance in obtaining more detailed information about MLS requirements, contact:

Joe W. Waters, MLS Principal Investigator
Mail Stop 183-701
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099 USA
Tel: (818) 354-3025
Fax: (818) 393-5065
Email: joe@mls.jpl.nasa.gov

A.III.4 TES Requirements for Spectroscopic Information

New measurements that could benefit TES algorithm development and validation must correspond to conditions to which TES algorithms will be applied, specifically:

pressures between 0.001 and 1 atm (1 to 1000 mb),

temperatures between 200 K and 300 K, and

spectral wavenumbers from 650 to 3000 cm^{-1} (wavelengths from 3.3 to 15.4 μm).

The molecules that will dominate TES spectra are water, carbon dioxide, ozone, methane, N_2O, CO, NO_2, NO, HNO_3, and chlorofluorocarbons. In sufficient quantities, other detectable species include SO_2, SF_6, OCS, NH_3, aerosols and a variety of hydrocarbons. General requirements for spectroscopic parameters are given below.

General TES Requirements for Spectroscopic Parameters

parameter type	Absolute Accuracy	
	linelist	cross sections
positions	0.002 cm^{-1}	0.01 cm^{-1}
intensities	3%	5 - 10 %
pressure-broadening	5%	
pressure-shifts	0.002 cm^{-1}	
temperature dependence		
intensities (lower states)	0.5%	
widths	15%	
pressure shifts	20%	

Compilation of Existing Data

Many laboratory measurements of spectral parameters have not yet been included in the HITRAN database and could provide significant improvements. Existing laboratory measurements of positions, intensities and pressure broadened coefficients need to be collected, assessed and compiled into HITRAN format, especially for dominant species like H_2O, O_3, CH_4, CO, NO_2, NO, N_2O and HNO_3 as well as other available data for species like C_2H_4 (ethylene) and HCOOH (formic acid). Emphasis should be placed on inclusion of weak lines that will contribute to detected signals arising at 0.5 atm and on the accurate characterization of the pressure-broadening.

New/Improved Spectroscopic Data

New studies are needed to characterize species for which spectroscopic information is missing or of poor accuracy. Specific priorities are given below.

Pressure broadening coefficients:

Temperature dependence of widths and shifts for H_2O
Temperature dependence of widths and shifts for CO (1-0 and 2-1 bands)
Temperature dependence of widths for the 6.2 µm band of NO_2

Aerosol spectral (infrared) properties

Cross sections using air-broadened gas samples, with adequate characterization of the temperature-pressure dependencies

PAN (Peroxyacetyl Nitrate) and PNA (Peroxynitric Acid) between 650 and 2500 cm^{-1}
Acetone and Acetic acid between 650 and 2000 cm^{-1}

Lower priority needs

Methanol line parameters at 10 µm
Cross sections of CH_3OOH (methyl hydroperoxide)

For assistance in obtaining more detailed information about TES requirements, contact:

Reinhard Beer, TES Principal Investigator
Mail Stop 183-301
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099 USA
Tel: (818) 354-4748
Fax: (818) 393-4445
Email: reinhard.beer@jpl.nasa.gov

APPENDIX B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

NASA Federal Acquisition Regulation (FAR), Supplement (NFS) Part 1852.235-72 , Effective JANUARY 2000

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies

required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) **Transmittal Letter or Prefatory Material.**

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
(vi) Identification of the NRA, by number and title, to which the proposal is responding;
(vii) Dollar amount requested, desired starting date, and duration of project;
(viii) Date of submission; and
(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information.** Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice
Restriction on Use and Disclosure of Proposal Information

The information (data) contained in *[insert page numbers or other identification]* of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative.

Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs (U.S. Proposals Only).**

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant

Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) Late Proposals. Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors.

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.
(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally **not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration** with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) **All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.**

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or

(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

(End of provision)

APPENDIX C Proposal Cover Sheet

NASA Research Announcement 00-OES-03
Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator::_____

Department:_____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ Congressional District:_____
(used for database sorting purposes only)

E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & Email Address	Address & Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:
1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i*) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and*
(ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____
Telephone: _____ E-mail:_____ Facsimile: _____

Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES
REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding $ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (l)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Current And Pending Research Support
From All Other Sources

All proposals must include this information. This list should include all current and pending research support from the following sources:

1. Any proposal for which the PI of this proposal is also the Principal Investigator.

2. Any proposal, regardless of the PI, which accounts for more than 20% of the time of the Principal Investigator of this proposal and other personnel essential to this proposal.

Please provide this information in the following format:

I. Principal Investigator

A. Current FY 2000 Support

1. Source of Support and Principal Investigator
2. Award Amount and Period of Performance
3. Person-Months and Level of Effort
4. Project Title and Short Abstract (50 words or less)

B. Pending Proposals (Excluding this proposal but including other proposals).

1. Source of Support and Principal Investigator
2. Award Amount and Period of Performance
3. Person-Months and Level of Effort
4. Project Title and Short Abstract (50 words or less)

For both current and pending support provide information on:

II. Co-Investigators

As outlined above, provide information on all Current and Pending Support. Disclosure of current and pending research support is not required for collaborators.

III. Other agencies to which this proposal, or parts thereof, has been submitted.

Suggested Contents

Letter of Intent

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to plan for adequate staff to handle the peer review process. This letter of intent form is available electronically via the Internet at URL: *http://www.earth.nasa.gov/LOI***.** We urge you to use these electronic letter of intent form unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

APPENDIX D

BUDGET SUMMARY

For period from _____ to _____

• Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
• Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
• Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on the following page for details.

		NASA USE ONLY	
	A	**B**	**C**
1. Direct Labor (salaries, wages, and fringe benefits)	_____	_____	_____
2. Other Direct Costs:			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. Facilities and Administrative Costs	_____	_____	_____
4. Other Applicable Costs:	_____	_____	_____
5. SUBTOTAL--Estimated Costs	_____	_____	_____
6. Less Proposed Cost Sharing (if any)	_____	_____	_____
7. Carryover Funds (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. Total Estimated Costs	_____	_____	XXXXXXX
9. APPROVED BUDGET	XXXXXX	XXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.

2. Other Direct Costs:
    a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
    b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
    c. Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
    d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
    e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
    f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.

3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.

4. Other Applicable Costs: Enter total, explaining the need for each item.

5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.

6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.

7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

APPENDIX E

Airborne Science Points-of-Contact and Flight Cost Estimates

The following is the guidance provided by NASA to potential users of NASA aircraft for Earth science measurements in FY2000. Investigators proposing usage of NASA aircraft resources should file the appropriate flight requests and budget accordingly, i.e., sensor support and maintenance, flight hour costs and realistic mission peculiar costs. Mission peculiar costs are additional expenses asociated with deployment of an aircraft away from homebase, such as travel for ground support crews, shipping of special support equipment, etc.

The following summarize the airborne program elements for FY 2000:

1. The core NASA Airborne Science fleet consists of the DC-8 and 2 ER-2s at Dryden Flight Research Center, and a P-3B at Wallops Flight Facility.

2. Other cooperative aircraft are available for Earth Science Enterprise supported missions. A NASA WB-57 at NASA's Johnson Space Center (JSC), will be available to complement the ER-2 requirements. A universal instrument interface was completed and effectively made the instrument electrical interface transparent to the user. The University of North Dakota (UND) operates a Citation II for atmospheric research, and the University of Washington, a CV-580. The Department of Energy's Remote Sensing Lab will continue to operate its Citation and King Air B200 in support of EOS instrument development. Subsidized flight rates for NASA Code Y are available on cooperative aircraft. You must submit a flight request to be considered for the flight hour subsidy.

3. The investigator/science team has funding responsibility for sensor support and maintenance. For budget planning purposes each investigator should use the core flight hour costs available from the appropriate points of contact.

4. The investigator/science team must carefully determine flight priorities and collaborate, to the greatest extent possible, with other investigators to minimize the number of specific flight request submittals.

An annual Call for Flight Requests goes out in the Spring with submissions due in the early Summer (e.g., submissions for FY 2000 were due June 4, 1999). A flight request form for all aircraft MUST be submitted directly to DFRC Airborne Science Directorate (Code Y). Completed flight requests and supporting documentation are to be sent to:

National Aeronautics and Space Administration
Dryden Flight Research Center
Airborne Science Directorate (Code Y)
P.O. Box 273 MS 1623H
Edwards, CA 93523-0273
Fax: 661-258-3917
Email: randy.albertson@dfrc.nasa.gov

In FY 2000, as in previous years, user fees for aircraft hours ("flight fees") have been instituted by the Office of Earth Science. Flight fees in FY 2000 are: ER-2 $2000/hour, DC-8 $3,000/hour, P-3B $3,000/hour, and DOE $1,400/hour; however, these fees are subject to change each year. Flight fees will be withheld automatically from each EOS investigator's budget and transferred directly to the appropriate flight account at Dryden or Wallops. However, the EOS Program and Project Offices will consider supporting up to 50% of EOS flight fees from a Special Aircraft Support Fund, subject to scientific priorities, programmatic balance, and availability of funds in FY 2000, with the remaining 50% or more coming from the individual investigator budgets. Depending upon the number and scope of the Flight Requests, the Special Aircraft Support Fund may also be used to pay mission peculiar costs (MPC). The total amount available for both flight fees and MPC will be up to $250K in FY 2000.

For your budget planning, further information on flight hour costs and estimates of mission peculiar costs can be obtained from the following individuals:

ER-2:	Larry Montoya/Dryden Flight Research Center 661-258-2775
DC-8:	Larry Montoya/Dryden Flight Research Center 661-258-2775
P-3B:	John Riley/Wallops Flight Facility 757-824-1529

For NASA cooperative or other NASA facility aircraft the same information can be obtained from the following individuals:

WB-57:	Gary Ash/Johnson Space Center 281-244-9651
Citation II:	Mike Poellot/University of North Dakota 701-777-3180
B200 & Citation:	Department of Energy (Jeff Myers NASA POC) 650-604-3598
Convair 580	Peter Hobbs/University of Washington 206-543-6026